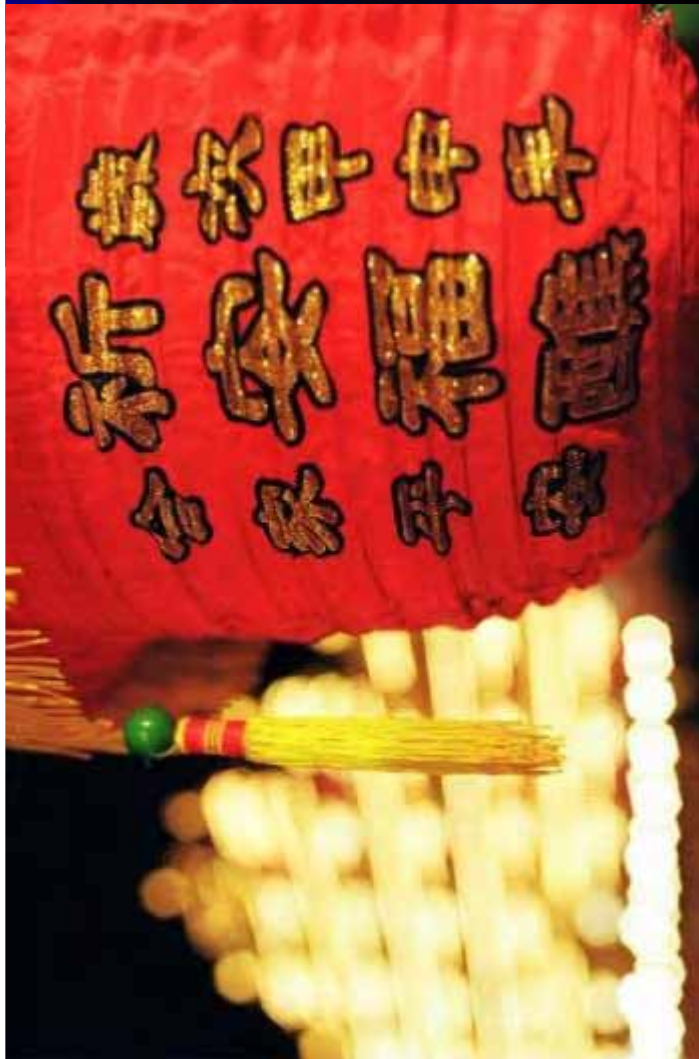


Genome

The molecular secret of our lives

Shin-Han Shiu
The Plant Biology Department
Michigan State University











3 parts

- **40 minutes**
 - Introduce yourselves...
 - presentation on what human genome is.
- **5 minute break**
- **20 minutes**
 - Genome playground
- **25 minutes**
 - Discussions on the implication of genome sequencing



NCBI Genomic Biology Homo sapiens

Search: All Databases (Enter) [Go] [Clear]

Browse your Genome
Click on the Chromosome to show

Genes

1 2 3 4 5 6 7 8
9 10 11 12 13 14 15 16
17 18 19 20 21 22 X Y

Find A Gene
Search for []
from Any species [Go]

The NCBI Handbook
An online guide to the use of NCBI resources.
Titles of selected chapters that refer to

Human Genome Resources

A challenge facing researchers today is that of piecing together and analyzing the plethora of data currently being generated through the Human Genome Project and scores of smaller projects. NCBI's Web site serves an integrated one-stop, genomic information infrastructure for biomedical researchers from around the world so that they may use these data in their research efforts. [More...](#)

Genes and Human Health

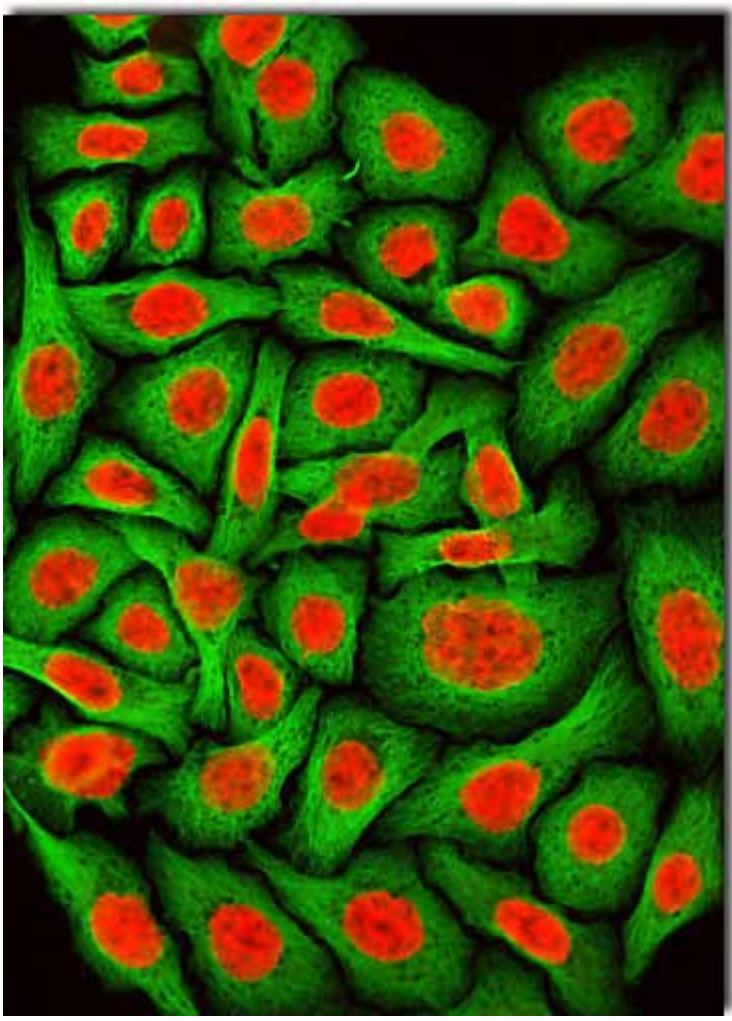
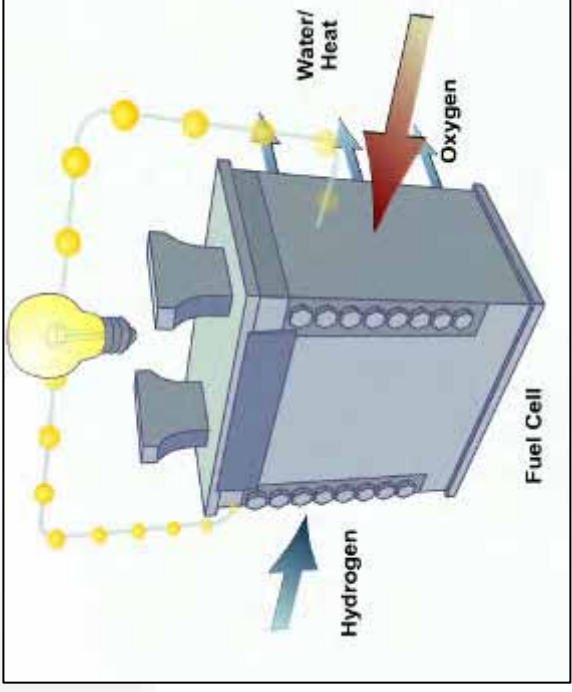
- **Gene Database**
A new database of genes and associated information is now available for searching in Entrez.
- **OMIM**
A guide to human genes and inherited disorders maintained by Johns Hopkins University and collaborators.
- **RefSeq**
Reference sequences of chromosomes, genomic contigs, mRNAs, and proteins for human and major model organisms.
- **dbSNP**
A database of single nucleotide polymorphisms (SNPs) and other nucleotide variations.



*What is the basis of human life,
at the most fundamental, scientific level?*



Units of life - cells

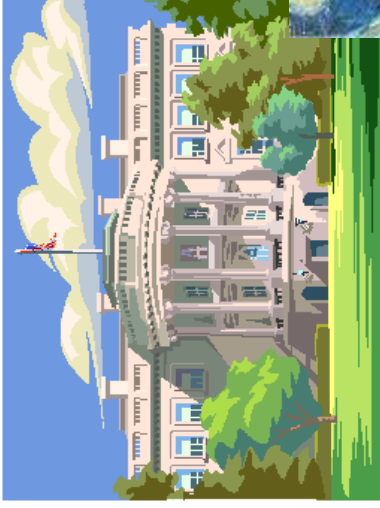




What's the number of cells in a human?

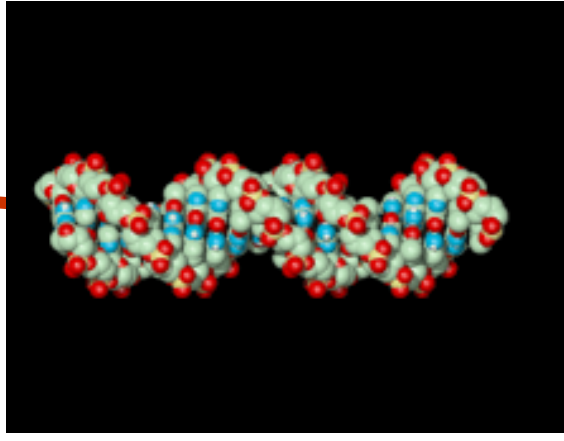
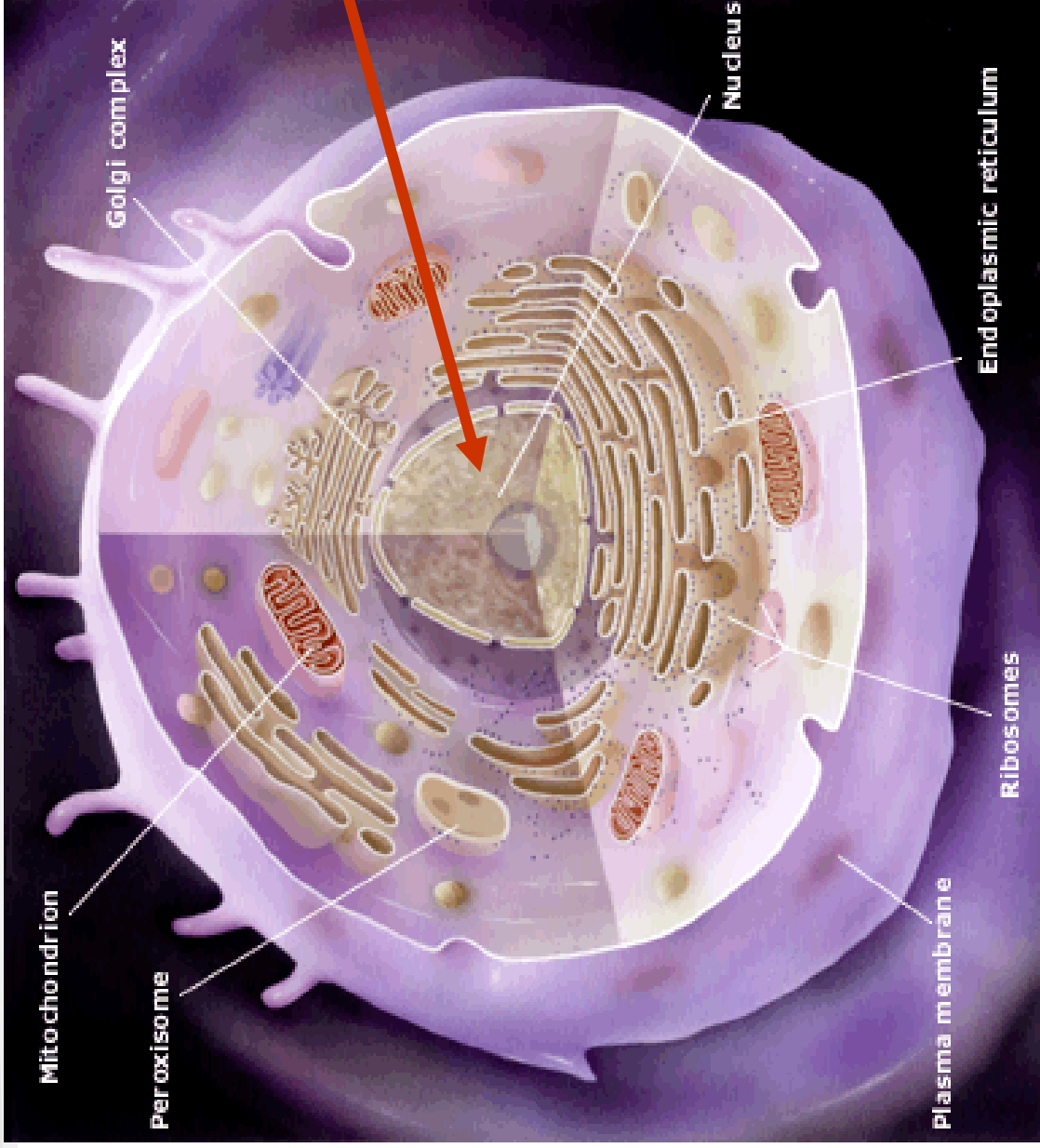
- In the order of...
- Price for a 4-bedroom house in EL
 - 179,900
 - Hundreds of thousands
- Number of people, 3/10, 2007
 - 6,582,693,730
 - billions
- US government 2008 budget
 - 2,770,000,000,000
 - trillions
- Number of stars in the universe
 - 1,000,000,000,000,000,000,000
 - billions of trillions

**~100,000,000,000,000
hundreds of trillions**





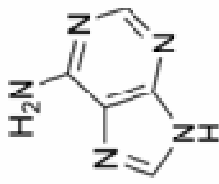
Cell, nucleus, and chromosomes



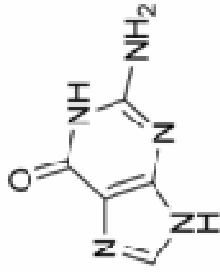


DNA

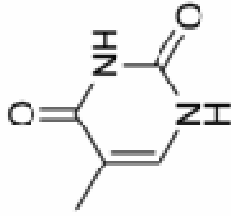
- Make up by As, Ts, Gs, and Cs



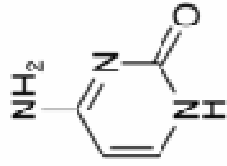
Adenine



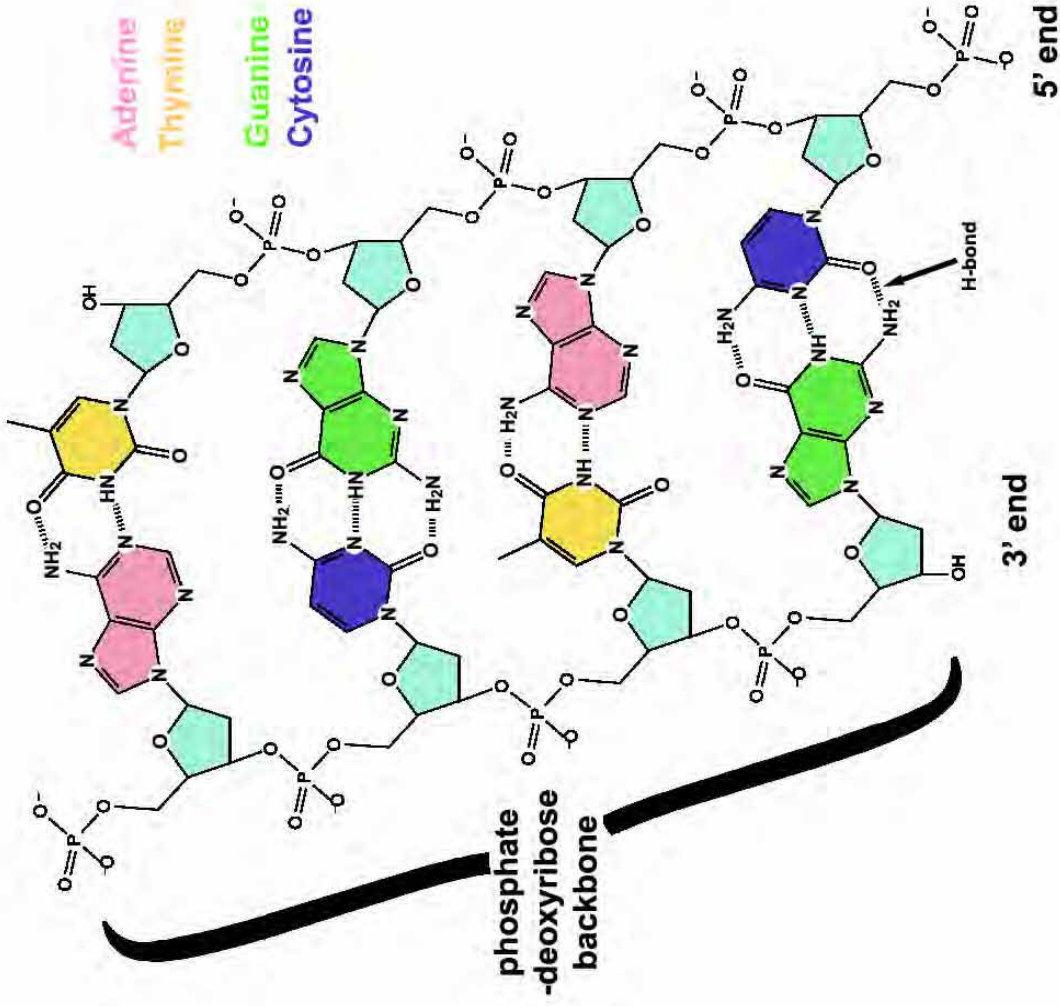
Guanine



Thymine

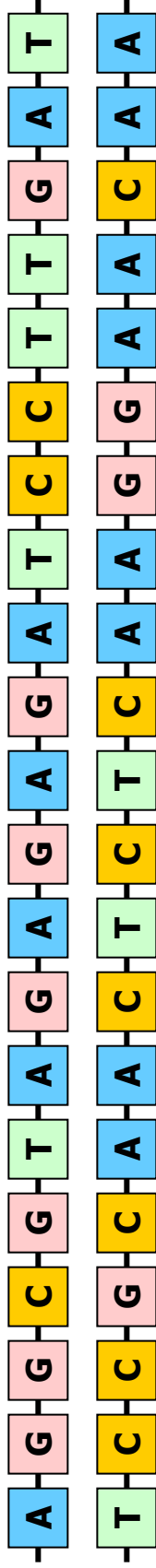


Cytosine





DNA





DNA and Genome

- Genome is all the DNA in a cell made up of A, T, G, C...
- How many A's, T's, G's, and C's are there in the human genome?

3,200,000,000 letters

- A sizable book, say, Lord of the Ring: Fellowship of the Ring

764,470 characters in 410 pages

~2,000 characters per page

- The book of our life

1,600,000 pages

4,186 Fellowship of the ring



Mapping the genome

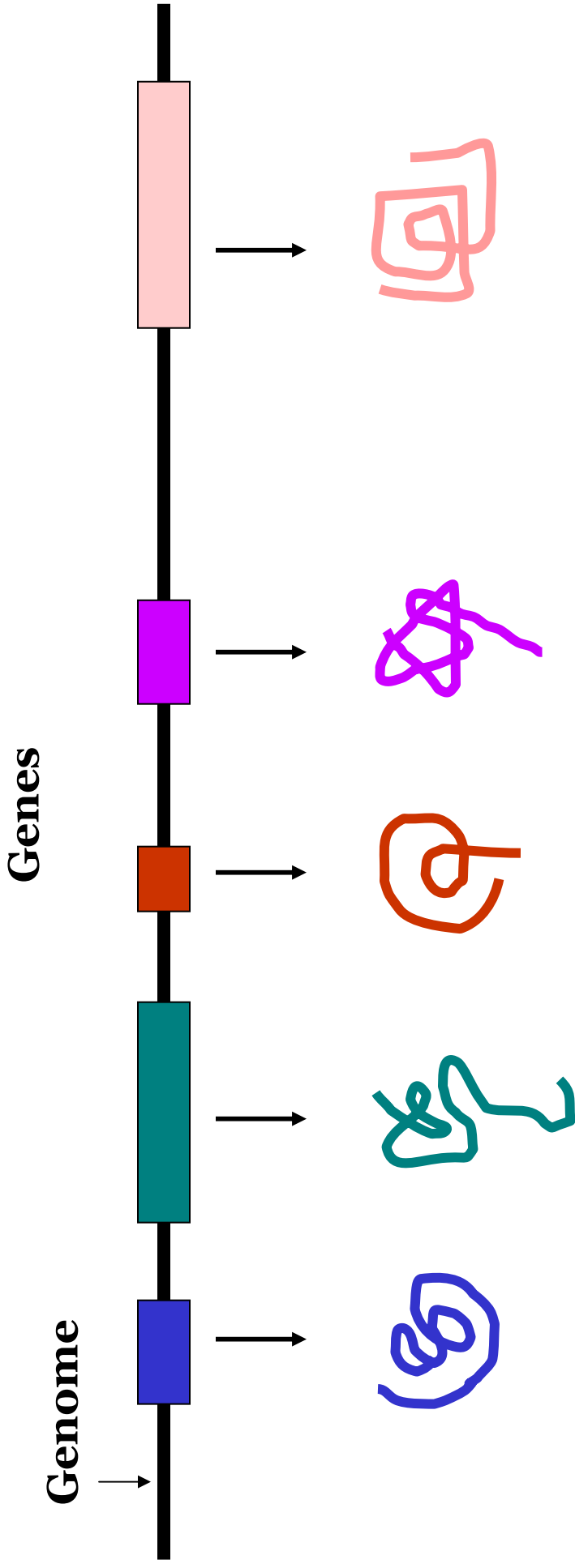
- We want to know exactly which letter is in every single position of the human genome.





Why do we want to map human genome

- To understand our "molecular self" and cure diseases





Parts work seamlessly to ensure normality

- Much like a machine

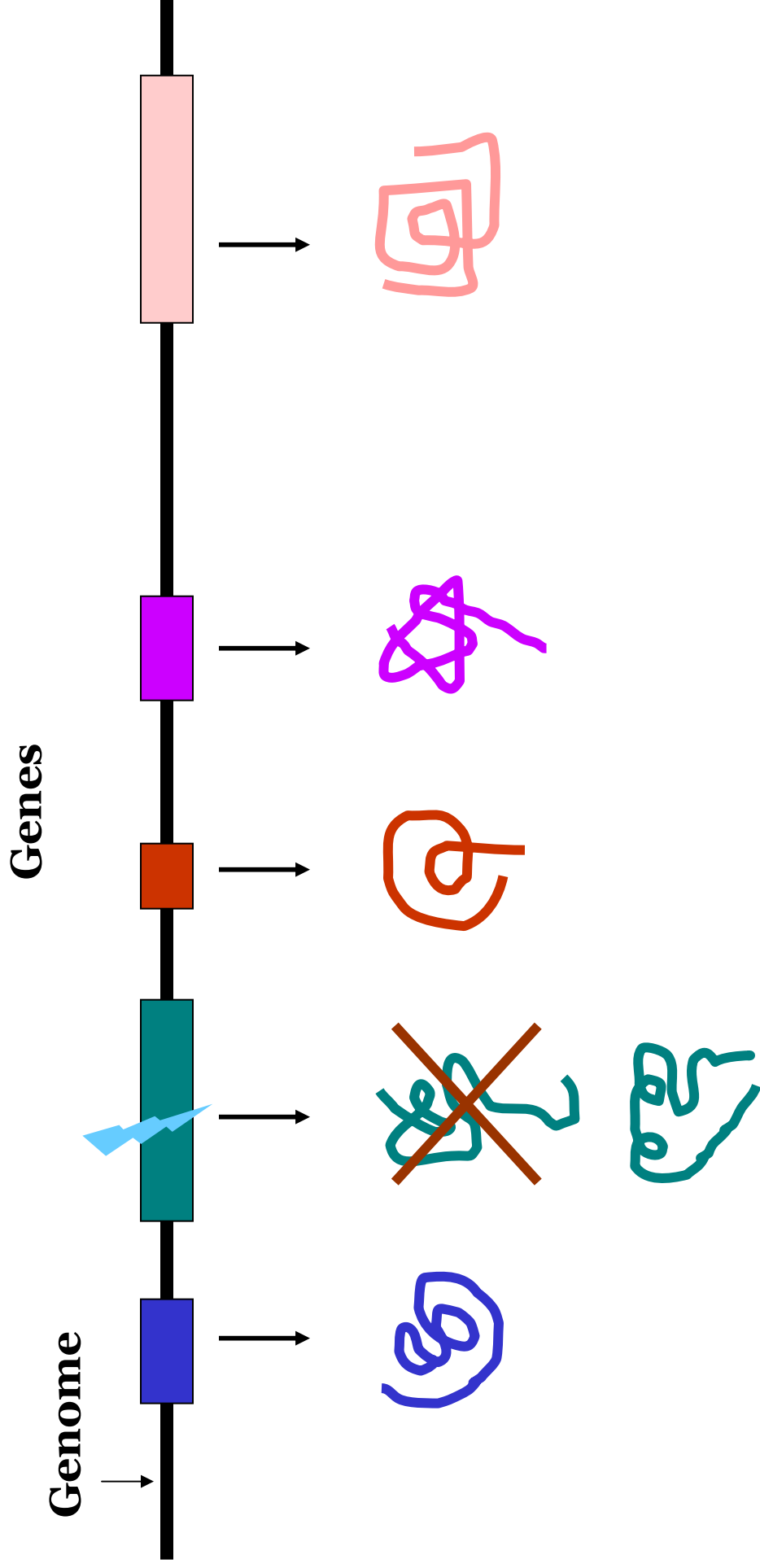


Malfunction ~ disease



Disease and genes

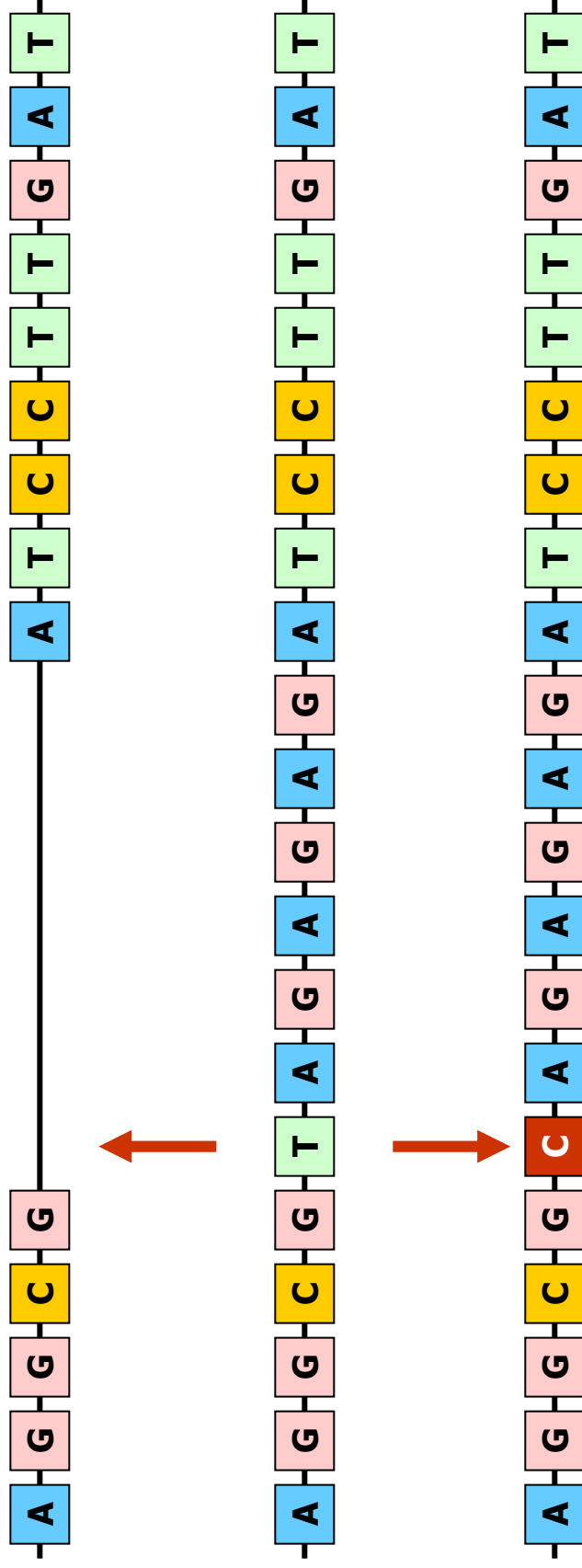
- Disabling mutation occurred in genes





Disease and genes

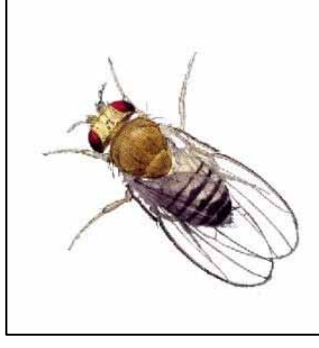
- Disabling **mutation** occurred in genes





History of the project

- 1990, launch of the Human Genome Project
- **Goal I**
 - Sequence all 3 billion letters in the human genome
 - Map all human genes and understand what they do
- **Goal II**
 - Sequence model organisms
- **Goal III**
 - Make sequence info available to everybody
- **Goal IV**
 - Study the ethical, social, and legal implications





Genome sequencing chronology

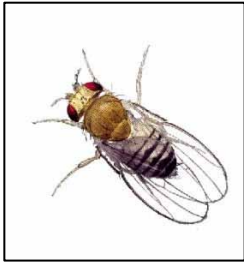
Year	Organism	Significance	Genome size (bp)	Number of genes
1977	Bacteriophage fX174	First genome ever!	5,386	11
1981	Human mitochondria	First organelle	16,500	37
1995	<i>Haemophilus influenzae</i> Rd	First free-living organism	1,830,137	~3,500
1996	<i>Saccharomyces cerevisiae</i>	First eukaryote	12,086,000	~6,000

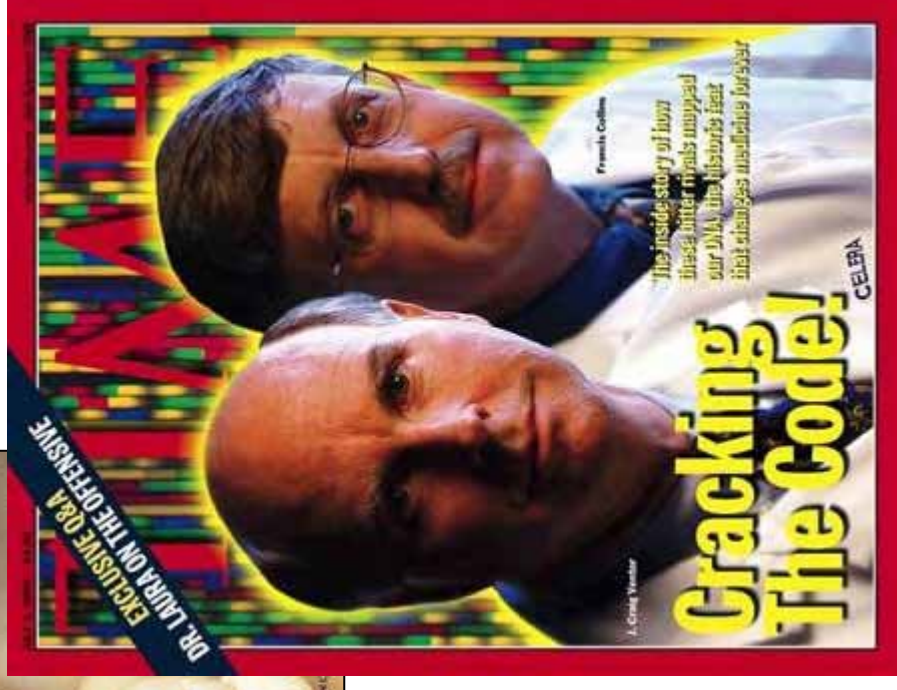
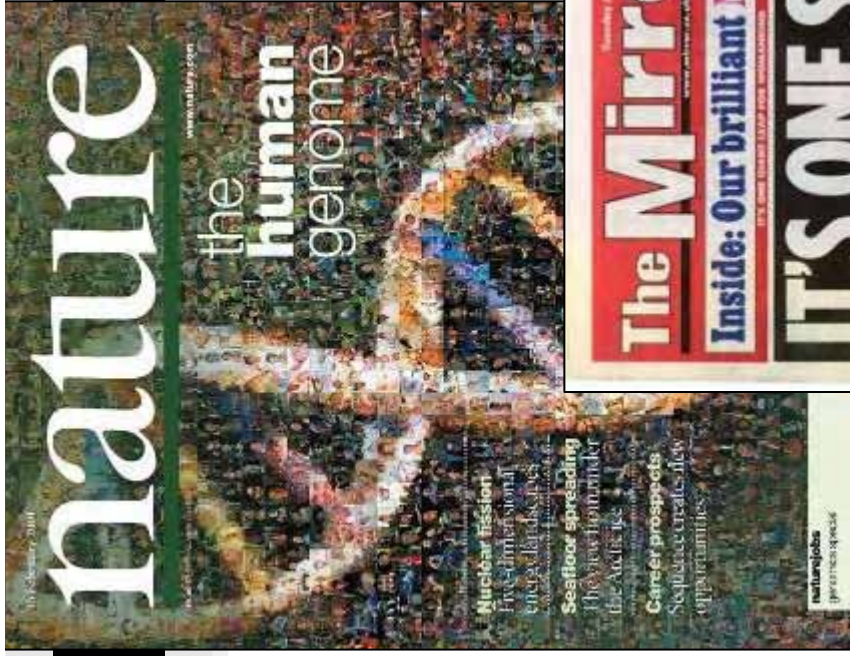




Genome sequencing chronology

Year	Organism	Significance	Genome size (bp)	Number of genes
1998	<i>Caenorhabditis elegans</i>	First multi-cellular organism	97,000,000	~19,000
1999	Human chromosome 22	First human chromosome	49,000,000	673
2000	<i>Drosophila melanogaster</i>	First insect	150,000,000	~14,000
2000	<i>Arabidopsis thaliana</i>	First plant genome	150,000,000	~25,000





2001



-
- Disease!**
- Normal**
- Disease!**



Personalized medicine

- Your **genome** contains much information on how harmonious different molecular components in your body work together.
- The **nature** part of the nature/nurture aspect of your health.
- **Genomic medicine**
 - A series of tests to determine if you are predispose for certain diseases or,
 - Your genome can be sequenced to determine if certain positions contain mutations that may lead to disease.



Sequencing cost

- **How much did the human genome sequencing project cost?**
 - \$3,000 Cost of a used car
 - \$300 thousand Cost of a nice house in East Lansing
 - \$300 million Lottery jackpot
 - \$3 billion Bill Gate's net worth (?)
- **If you can get your genome sequenced NOW, how much are you willing to spend?**
 - \$10
 - \$100
 - \$1,000
 - \$10,000
 - \$100,000

FOR IMMEDIATE
RELEASE
Thursday, October
14, 2004

CONTACT:
[Geoff Spencer](#)
301-402-0911

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NHGRI Seeks Next Generation of Sequencing Technologies

New Grants Support Development of Faster, Cheaper DNA Sequencing

Bethesda, Maryland — The National Human Genome Research Institute (NHGRI), part of the National Institutes of Health (NIH), today announced it has awarded more than \$38 million in grants to spur the development of innovative technologies designed to dramatically reduce the cost of DNA sequencing, a move aimed at broadening the applications of genomic information in medical research and health care.

NHGRI's near-term goal is to lower the cost of sequencing a mammalian-sized genome to \$100,000, which would enable researchers to sequence the genomes of hundreds or even thousands of people as part of studies to identify genes that contribute to cancer, diabetes and other common diseases. Ultimately, NHGRI's vision is to cut the cost of whole-genome sequencing to \$1,000 or less, which would enable the sequencing of individual genomes as part of medical care. The ability to sequence each person's genome cost-effectively could give rise to more individualized strategies for diagnosing, treating and preventing disease. Such information could enable doctors to tailor therapies to each person's unique genetic profile.



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Contact: Lane Soelberg, 310.582.5902
press@xprize.org
www.xprize.org

X PRIZE Foundation Announces Largest Medical Prize in History

\$10 Million Archon X PRIZE for Genomics Challenges Private Companies to Map 100 Human Genomes in 10 Days

Washington D.C. (October 4, 2006) — The X PRIZE Foundation announced today the \$10 million Archon X PRIZE for Genomics — A multi-million dollar incentive to create technology that can successfully map 100 human genomes in 10 days. The prize is designed to usher in a new era of personalized preventative medicine and stimulate new avenues of research and development of medical sciences.



Now, 1366 genomes are sequenced or being sequenced





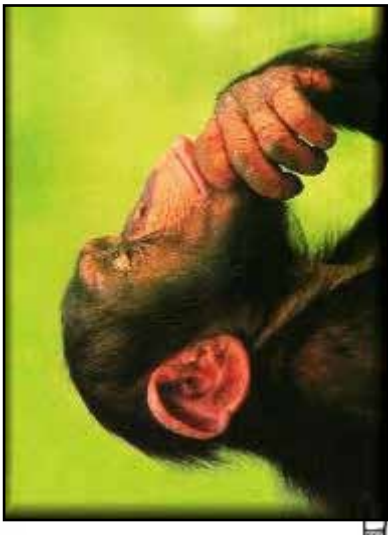
Between human and other animals

- **How much do our and chimp genomes differ?**

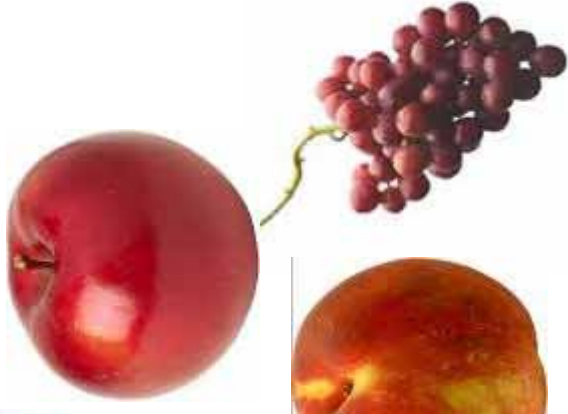
- 0.1%
- 1%
- 10%
- 50%
- 90%

- **How many genes do you think we share with worm?**

- 1%
- 10%
- 50%
- 75%
- 99%



Genome and better food





Better understanding of science and our environment





National Science Foundation, 2 year project



Important crop



**Comparative analysis with
genomes of close related
species**



Important ecological model system



Invasive species

RadishDB

(Redirected from Main Page)



institution home

- Michigan State Univ.
- TIGR
- RadishDB

project menu

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- About radish
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- Sequence data
- Analysis results
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About/contact us

What this is about and who are.

About radish

What's radish? Why sequence radish?

The project

Goals of the project and additional information.

Sequence data

Information on current progress and links to sequence search and download.

Analysis results

Information on the analyses we have done using radish EST sequences.

Links

Useful links related to radish research, including radish community and publication lists.





Take a break...





Genome Playground

- Please go to the following website:

http://shiulab.plantbiology.msu.edu/wiki/index.php/ELPL_2007



Ethical, legal, and social issues

- **Suppose genome sequencing is common place and essentially everybody in the states, except those who can not afford health care.**
- **Your genome sequence is now stored, say, in a DVD with your health care provider.**
- **Talk to your neighbor and discuss about why and why not the following types of people can have access to your genomes:**
 - Law enforcement agents
 - Your employer
 - Scientists studying human diseases
 - Your relatives such as parents, siblings, etc.



Aknowledgement

- **First of all, THANK YOU!**
- **East Lansing Public Library**
 - Julie Pearce
- **National Human Genome Research Insitute**
 - Educational resources
- **National Science Foundation**
 - Plant Genome Comparative Sequencing Program
 - Funding that make this possible

